AMENDMENTS TO THE CLAIMS

The following listing of claims will replace all prior versions and listings of claims in the application.

LISTING OF CLAIMS

1. (Currently Amended) A cooling system for cooling a friction device, comprising:

a flow control device that controls a flow of cooling fluid through said friction device; and

a controller that estimates at least one temperature state that includes a bulk friction device temperature of said friction device based on an estimated heat rate of said friction device, calculates a flow command based on said temperature state and operates said flow control device based on said flow command,

wherein said temperature state is based on at least one of an approximate thermal inertia of said friction device and heat rejection of at least one of said friction device and said cooling system.

2. (Cancelled).

3. (Previously Presented) The cooling system of claim 1, wherein said controller determines a friction device torque and a friction device slip speed and calculates said heat rate of said friction device based on said friction device torque and said friction device slip speed signal.

4. (Previously Presented) The cooling system of claim 1, further comprising:

a sump for collecting said flow of fluid; and

a sump temperature sensor that generates a sump temperature signal, wherein said temperature state is further based on said sump temperature signal.

5. (Previously Presented) The cooling system of claim 1, wherein said temperature state is further based on a current flow command.

6. (Previously Presented) The cooling system of claim 1, wherein said flow command is further based on said heat rate of said friction device and a sump temperature of said flow of fluid.

7-8. (Cancelled).

9. (Original) The cooling system of claim 1, wherein said temperature state is a thermal energy of said friction device.

10. (Currently Amended) A method of controlling cooling of a friction device, comprising:

estimating a temperature state of a component of said friction device based on an estimated heat rate of said friction device;

calculating a flow command based on said temperature state; and

controlling a cooling fluid flow through said friction device based on said flow command,

wherein said temperature state is estimated based on a loop time of a thermal model of said friction device.

11. (Cancelled).

12. (Previously Presented) The method of claim 10, wherein said heat rate is based on a friction device torque and a friction device slip speed.

13. (Previously Presented) The method of claim 10, further comprising measuring a temperature of said fluid flow, wherein said temperature state is further based on said temperature.

14. (Previously Presented) The method of claim 10, wherein said temperature state is further based on a current flow command.

15. (Previously Presented) The method of claim 10, wherein said flow command is further based on said heat rate of said friction device.

16. (Previously Presented) The method of claim 10, wherein said flow command is further based on a temperature of said fluid flow.

17-18. (Cancelled).

19. (Previously Presented) The cooling system of claim 10, wherein said temperature state is a thermal energy of said friction device.

20. (Currently Amended) A method of controlling cooling of a friction device, comprising:

calculating a heat rate of said friction device;

estimating a temperature state that includes a bulk temperature of said friction device based on said heat rate;

determining a flow command based on said temperature state; and

operating a flow control device based on said flow command to control a cooling fluid flow into said friction device,

wherein said temperature state is estimated based on a thermal model of said friction device, and

wherein said thermal model performs as a low-pass filter.

21. (Original) The method of claim 20, further comprising:

determining a friction device torque; and

determining a friction device slip speed, wherein said heat rate is based on said friction device torque and said friction device slip speed.

22. (Original) The method of claim 20, further comprising measuring a temperature of said fluid flow, wherein said temperature state is further based on said temperature.

23. (Previously Presented) The method of claim 20, wherein said temperature state is further based on a current flow command.

24. (Previously Presented) The method of claim 20, wherein said flow command is further based on said heat rate and a temperature of said fluid flow.

25. (Cancelled).

26. (Previously Presented) The method of claim 20, wherein said temperature state is a thermal energy of said friction device.

27-31. (Cancelled).

32. (Previously Presented) The cooling system of claim 1 wherein said temperature state is based on a loop time of a thermal model of said friction device.

33. (Currently Amended) The cooling system of claim 1 wherein said temperature state is based on a thermal module according to $\cancel{T_{C deriv} = \left(\frac{1}{M_{clutch}}\right)\left(H_R - K_{diss}\left(T_C - T_{sump}\right)\right)}$ $\underline{T_{C deriv} = \left(\frac{1}{M_{friction device}}\right)\left(H_R - K_{diss}\left(T_C - T_{sump}\right)\right)}$, where $T_{C deriv}$ is a derivative of said temperature state, $\cancel{M_{clutch}}$ $\underline{M_{friction device}}$ is <u>approximate</u> thermal inertia of said friction device, H_R is said heat rate, K_{diss} is heat rejection of said friction device, T_C is said temperature state and T_{sump} is a sump temperature.

34. (Previously Presented) The cooling system of claim 1 wherein said temperature state is based on a thermal model of said friction device, and

wherein said thermal model performs as a low-pass filter.

35. (Previously Presented) The cooling system of claim 34 wherein said low-pass filter tracks $\frac{H_R}{K_{diss}} + T_{sump}$, where H_R is said heat rate, K_{diss} is heat rejection of said friction device, and T_{sump} is a sump temperature.

36. (Currently Amended) The cooling system of claim 35 wherein said low-pass filter tracks $\frac{H_R}{K_{diss}} + T_{sump}$ with a time constant of $\left[\left[\frac{M_{clutch}}{K_{diss}}\right]\right] \underline{\frac{M_{friction\,device}}{K_{diss}}}$, where $\cancel{M_{clutch}}\, \underline{M_{friction\,device}}$ is thermal inertia of said friction device.